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(54) Title: INTERMEDIATE ABSORBENT STRUCTURE WITH INTEGRATED BREATHABLE BARRIER

(57) Abstract: The invention relates to an improved intermediate absorbent structure with an integrated air permeable fluid barrier, said structure intended to be included inside at least one external layer in the finished absorbent article and intended to eliminate a need for a secondary fluid barrier between the absorbent core and the external layer. Said structure is manufactured in the form of a continuous web that can be converted into disposable absorbent articles. The invention comprises (a) an upper layer that is liquid permeable, (b) a lower layer with a hydrohead greater than 8 cm and an air permeability less than 1000 m/s at 196 Pa, and (c) an intermediate layer of absorbent material dispersed between the upper layer and the lower layer. Preferred embodiments include intermediate structures where the lower layer comprises a composite of fine fibers and continuous filaments.

Intermediate Absorbent Structure with Integrated Breathable Barrier

This invention relates to intermediate absorbent structures comprising an upper layer that is liquid permeable, a lower layer and an intermediate layer arranged between said upper layer and said lower layer, said intermediate layer comprising absorbent material preferably comprising superabsorbent polymer in the form of particles or small fibers dispersed between said upper layer and said lower layer, and optionally comprising a thermoplastic bonding agent, wherein said absorbent core is produced as part of a continuous web of absorbent cores, wherein the width of said continuous web is approximately equivalent to the width of a multiple number of cores, wherein said absorbent material is deposited in a defined pattern, as defined in the preamble of patent claim 1.

Intermediate absorbent structures as defined in the preamble of claim 1 are known from EP 0 708 628 B1. Intermediate absorbent structures of this type serve to provide, by means of an off-line process, intermediate multilayer absorbent structures and products, incorporating powders or fibers or granules of absorbent material, which products may also be of

small size, with a maximum design flexibility and without appreciable additional costs from modifying the shape or the structure of the absorbent article.

Although intermediate absorbent structures known from EP 0 708 628 B1 do have a number of advantages, it has, however, being found that they do have also some disadvantages and shortcomings.

For better understanding of the invention, as used herein, the term "absorbent structure" refers to disposable absorbent articles for personal or medical care, such as catamenial devices, incontinence devices, diapers, dressings and the like. They may also be used for household or industrial applications, such as cleaning devices. Intermediate structures are manufactured in the form of a continuous web that can be converted into absorbent articles. In final absorbent articles, said absorbent structures are often covered by an external covering material.

The basic functions of absorbent products such as catamenial devices, incontinence devices, diapers, dressings and the like are the acquisition, storage and containment of fluids. Additional demands include providing comfort or minimizing discomfort, and maintaining skin health. Efforts to respond to the basic demands have led to the creation of a variety of multilayer articles ranging from simple fluff-pulp structures, for example as disclosed in US Pat. No. 4,223,677 to Anderson or US Pat. No. 3,768,480 to Repke and Mesek, to com-

plex structures containing several layers of different types of materials, for example as disclosed in US Pat. No. 5,246,429 to Poccia et al. Common elements in absorbent article designs include a fluid permeable surface material to be placed adjacent to the site of fluid discharge, a fluid storage core, and a fluid impervious surface external to the storage core. Early designs of, for example, catamenial pads contained as few as two different materials, the inner pulp storage core and the outer tissue wrap. Recent developments of improved formulations of absorbent articles have resulted in more complex multilayer, multicomponent articles that may include superabsorbent materials in the form of particles, powder or fibers. A variety of forms and configurations of superabsorbent materials and fibrous materials as storage cores in absorbent articles are known in the art.

As is well known to one versed in the art, the application of nonwoven materials to absorbent articles has permitted progressive improvements in absorbent product design, notably with respect to materials used for the layers external to the article's storage core. For example, diaper topsheet material has progressed from simple tissue with relatively poor strength and rewet properties to more durable synthetic nonwoven webs with improved fluid transfer capability.

A key challenge for absorbent articles is to permit fluid transport within the core while preventing transmission of fluid from the core to the external layer of the article and exiting the article. As such, a layer of an absorbent article that lies external to the core must generally constitute a

barrier with low fluid permeability as disclosed in US Pat. No. 4,578,069 to Whitehead and Braun. In early absorbent article designs, such as those for diapers, said fluid barrier layer was composed of a liquid impermeable, air impermeable film. Unfortunately, such an impervious barrier layer can result in significant discomfort due to entrapment of heat and moisture, that in extreme cases can lead to skin irritation and injury. More recent innovations in external barrier layers have introduced the additional function of providing a breathable interface with the environment to maintain skin health, as disclosed in US Pat. No. 5,843,056 to Good et al., and to assist odor control, as disclosed in US Pat. No. 4,578,069 to Whitehead and Braun, where a breathable interface is considered to be one that transmits water vapor. Said breathable interfaces include thin films, porous films, film-nonwoven composites, and nonwoven laminates, as disclosed for example in US Pat. No. 4,777,073 to Sheth, European Pat. No. 0352802 to Antoon and Hill, US Pat. No. 4,818,600 to Braun et al., and European Pat. No. 0700465B1 to Butt et al., respectively. However, the extent of breathability of the external barrier is limited by the requirement that said layer also function as an effective fluid barrier. Furthermore, the breathability of such an external barrier may be reduced where fluid comes into contact with such a barrier, as is the case where an absorbent material such as air-laid pulp is adjacent to the external barrier.

In some instances, as disclosed for example in US Pat. No. 4,425,130 to Desmarais, a secondary fluid barrier may be incorporated internal to a primary fluid barrier with the in-

tention of ensuring that failure of the primary barrier does not lead to leakage from the core. Examples of absorbent articles where a vapor permeable fluid barrier for an absorbent article is placed between the absorbent core and the backsheet or external cover of the article include the inventions disclosed in US Pat. No. 5,879,341 to Odorzynski and Sherman, in US Pat. No. 5,643,239 to Bodford and Nayak, and in German Pat. DE3717992 to Haegler and Huebner. A breathable barrier between an absorbent core and a breathable liquid impervious external cover is also disclosed in WO 98/27920 to Strack et al., with reference to absorbent articles having reduced outer cover dampness. However, this secondary barrier approach involves additional converting steps during absorbent article production.

The production of absorbent articles can be simplified and rendered more economical through the use of intermediate absorbent products. Such intermediate products may constitute, for example, the absorbent storage core of a personal care article, as disclosed in European Pat. No. 0 648 101 to Palumbo and Carlucci. Other examples of intermediate absorbent articles are disclosed in European Pat. No. 0 729 735 to Helyranta et al., and European Pat. No. 0 463 716 to Makoui. The production of intermediate absorbent articles can be rendered even more practical and economical by producing a continuous web of cores the width of more than one core, as disclosed in EP 708 628 B1.

The advantage of the known intermediate absorbent articles is the simplification of final article production and the vari-

ety of final products possible from a standardized intermediate core.

However, the properties of these and other intermediate cores are generally restricted to the traditional requierement of absorbent cores, i. e. fluid storage. The function of leakage prevention and containment has traditionally been provided for by one or more, not inexpensive outer layers.

It is an object of the present invention to provide an intermediate absorbent structure which overcomes the aforementioned shortcomings and disadvantages; which may be produced at minimum costs and which supports and improves the characteristics of the final absorbent product.

These objects are accomplished by the invention thanks to the features of the characterising portion of claim 1. Other advantages and practical features are the subjects of the dependent claims.

According to the invention, an intermediate absorbent structure as defined in the preamble of claim 1 is characterised in that the lower layer the lower layer has a hydrohead greater than 8 cm and an air permeability less than 1000 m/s at 196 Pa, and that is comprising material selected from the group of microporous films, thin nonporous films, film-nonwoven composites, and composites of fine fibers and continuous filaments.

In other words, the problems of the prior art are solved by a lower layer consisting of a material which is fluid impermeable but water vapor permeable. This material may be a synthetic film, a nonwoven or a film-nonwoven composite.

Surprisingly, a number of advantages may be achieved by using materials as defined in the characterising portion of claim 1 in the lower layer. As the lower layer prevents leakage of fluids, the backsheet material or an external covering of the final product may now be made of less expensive materials and of materials having better characteristics for the user, respectively.

Surprisingly, the incorporation of a fluid barrier into an intermediate absorbent structure will contribute to the simplification of absorbent article production and will provide more freedom in the formulation of external layers, particularly where improved air permeability is desirable. Such a core-integrated fluid barrier will also provide more flexibility in the design of external layers with specific esthetic properties, such as color, hand, loudness and the like.

Commonly, materials having these properties are used as backsheet material for diapers and similar disposable absorbent articles for personal or medical use. Due to the fact, that these materials were already in use, it has been common practice not to include these materials in manufacturing absorbent structures as intermediate products.

A fluid impermeable barrier that is integrated into the intermediate absorbent structure of an absorbent article also eliminates the need for a secondary external layer to act as a back-up in case of failure of the external layer. In some absorbent articles, the use of a core with an integrated barrier could also permit a reduction in the amount or thickness of absorbent materials in the core, thereby improving the wearing comfort of the finished article. As the absorption capacity of, for example, air-laid pulp, is substantially lower than that of superabsorbent materials, the presence of a barrier layer of nonabsorbent nonwoven integrated into an absorbent core would permit the replacement of a significant quantity of air-laid pulp with a relatively small amount of superabsorbent material. Obviously, a reduction in the quantity of raw materials in a given article could provide an economic benefit as well.

A layered intermediate absorbent structure comprising a breathable barrier composite will be produced according to the teachings of EP 0 708 628 B1, incorporated herein in its entirety by reference.

Hydrostatic head can be evaluated using Edana Recommended Test Method (RTM) 160.0-89 for Nonwovens Wet Barrier. Air permeability can be measured according to Edana RTM 140.1-99 for Nonwovens Air Permeability amended such that the pressure drop is 196 Pa (as in Edana RTM 140.1-81) instead of 200 Pa.

Said liquid permeable upper layer is selected from the group woven fabric, nonwoven fabric, synthetic film, tissue paper,

air laid paper, air laid composites, and composites of fine fibers and continuous filaments. In one embodiment, the upper layer comprises air laid cellulose fibers with a basis weight in the range 20-1000 g/m², preferably in the range 20-500 g/m². Basis weight can be evaluated according to Edana RTM 40.3-90 for Nonwovens Mass per Unit Area. Alternatively, the material of the upper layer may comprise 50-100 % cellulose. Furthermore, the upper layer may comprise at least 1% synthetic materials selected from the group polyolefins, polypropylene, polyethylene, polyamides and polyesters.

The layer of absorbent material comprises material selected from the group absorbent gelling material, absorbent particles, superabsorbent particles, absorbent fibers and superabsorbent fibers. The absorbent material can be either a single absorbent material or a blend of absorbent materials, comprising material that is capable of turning into a gel upon being wetted, and thus retaining large amounts of fluid with respect to its own original volume. Preferred materials in this respect are the so-called superabsorbent polymers or SAP, in the form of particles, powders or fibers, however, according to the invention other known absorbent materials can be used, both in powder and fiber form. A variety of such materials are known to the art.

In a preferred embodiment, said layer comprises superabsorbent gelling material in the form of particles. In addition, the absorbent material may comprise material with an odor absorbing or odor controlling function such as, for example, zeolites, silica, carbon or pH-regulating material. The basis

weight of the deposited absorbent material, measured in the product and with respect to the deposited areas, is preferably from 10 to 1000 g/m^2.

Said absorbent material may be deposited as a single layer or as multiple layers between the upper and lower layers of the article. Alternative to the deposition of absorbent material in between containing layers, an absorbent composite may be formed by the mixing of absorbent material with accompanying supporting fibers comprising natural or synthetic fibers, and optionally including bicomponent binder fibers, as may be formed using conventional air laid technology.

In a preferred embodiment of the invention, the lower layer comprises a composite of fine fibers and continuous filaments with a total basis weight of fine fibers in the range 2 to 40 g/m^2, and a total basis weight of continuous filaments in the range 8 to 48 g/m^2. The production of such composites is well described in the art. Most preferably, said composite of fine fibers and continuous filaments comprises a spunbond-meltblown composite with a spunbond layer with a basis weight in the range 4 to 24 g/m^2 and a meltblown layer with a basis weight in the range 2 to 20 g/m^2. Alternative composite compositions are a spunbond layer with a basis weight in the range 10 to 20 g/m^2 and a meltblown layer with a basis weight in the range 2 to 12 g/m^2, or a spunbond layer with a basis weight in the range 2 to 9 g/m^2 and a meltblown layer with a basis weight in the range 1 to 2 g/m^2. In an additional embodiment, the composite of fine fibers and continuous filaments comprises at least one spunbond layer and at least one

meltblown layer. The material of the lower layer is selected from the group polyolefins, polypropylene, polyethylene, polyamides and polyesters, most preferably from the group polyethylene and polypropylene.

The formation of simple spunbond-meltblown composites is known to the art. In a preferred embodiment, the spunbond-meltblown composite of the lower layer is manufactured using a forming line that comprises at least one station for the melt extrusion of continuous filaments and at least one station for the melt extrusion of fine fibers. The line preferably comprises one continuous filament station and one fine fiber station, the fine fiber station preferably lying downline from the continuous filament station. In the case of a simple two-layer composite, the continuous filaments are formed by the extrusion of molten polymer through spinnerets followed by the drawing of the filaments and the depositing of the filaments in a random fashion on a moving belt. Fine fibers produced by the meltblown technique are then deposited onto the continuous filament layer in a random fashion. Downline of the extrusion stations, the composite is intermittently bonded using a heated calender. Rolling and possibly slitting of the composite may follow bonding.

In the drawing is shown a non-limitating example of an intermediate absorbent structure 1 comprising an upper layer 2 and a lower layer 3 and an intermediate layer 4. Said intermediate layer 4 is closely enveloped in between the upper layer 2 and the lower layer 3.

Upper layer 2 and lower layer 3 are bonded together by adhesive strips 5.

The physical properties of lower layer 3 are differing from the physical properties of upper layer 2, as described above.

Those skilled in the art will recognize that the absorbent core with integrated fluid barrier of this invention may be used in a variety of final absorbent articles such as for example catamenial pads, diapers, incontinence devices, wound dressings and in other applications or products not disclosed in the preceding description, particularly in final articles comprising a backsheet or external covering with significant air permeability.

Claims

1. An intermediate absorbent structure comprising

a) an upper layer that is liquid permeable,

b) a lower layer and

c) an intermediate layer arranged between said upper layer and said lower layer, said intermediate layer comprising absorbent material preferably comprising superabsorbent polymer in the form of particles or small fibers dispers between said upper layer and said lower layer, and optionally comprising a thermoplastic bonding agent, wherein said absorbent core is produced as part of a continuous web of absorbent cores, wherein the width of said continuous web is approximately equivalent to the width of a multiple number of cores, wherein said absorbent material is deposited in a defined pattern, characterized in that the lower layer has a hydrohead greater than 8 cm and an air permeability less than 1000 m/s at 196 Pa, and that is comprising material selected from the group of microporous films, thin nonporous films, film-nonwoven composites, and composites of fine fibers and continuous filaments.

2. The continuous web of cores of claim 1 comprising individual cores of width in the range 20-2000 mm.

3. The continuous web of cores of claim 1 wherein the width of said web is approximately equivalent to the width of a single core.

4. The upper layer of claim 1 selected from the group of woven fabric, nonwoven fabric, synthetic film, perforated film, tissue paper, air laid paper, air laid composites, and composites of fine fibers and continuous filaments.

5. The lower layer of claim 1 wherein the hydrohead is in the range 20-40 cm.

6. The lower layer of claim 1 wherein the hydrohead is in the range 40-60 cm.

7. The lower layer of claim 1 comprising a hydrophilic additive.

8. The lower layer of claim 1 preferably comprising a composite of fine fibers and continuous filaments.

9. The composite of fine fibers and continuous filaments of claim 7 with a basis weight of fine fibers in the range 2 to 40 g/m^2, and a total basis weight of continuous filaments in the range 8 to 48 g/m^2.

10. The composite of fine fibers and continuous filaments of claim 7 comprising a spunbond-meltblown composite.

11. The composite of claim 7 comprising a spunbond layer with a basis weight in the range 4 to 24 g/m^2 and a meltblown layer with a basis weight in the range 2 to 20 g/m^2.

12. The composite of claim 7 comprising a spunbond layer with a basis weight in the range 10 to 20 g/m^2 and a melt-blown layer with a basis weight in the range 2 to 12 g/m^2.

13. The composite of claim 7 comprising a spunbond layer with a basis weight in the range 2 to 9 g/m^2 and a meltblown layer with a basis weight in the range 1 to 2 g/m^2.

14. The composite of fine fibers and continuous filaments of claim 7 comprising at least one spunbond and at least one meltblown layer.

15. The intermediate layer of absorbent material of claim 1 comprising absorbent material selected from the group absorbent gelling material, superabsorbent particles and superabsorbent fibers.

16. The intermediate layer of absorbent material of claim 1 comprising odor regulating material selected from the group zeolites, silica, clay, carbon and pH regulating compounds.

17. An integrated absorbent core comprising (a) an upper layer that is liquid permeable, (b) a lower layer with a hy-

drohead greater than 8 cm and an air permeability less than 1000 m/s at 196 Pa, and comprising a composite of fine fibers and continuous filaments where the total basis weight of fine fibers is in the range 2 to 40 g/m^2 and the total basis weight of continuous filaments is in the range 8 to 48 g/m^2, and (c) an intermediate absorbent layer comprising absorbent gelling material and odor regulating material, wherein said absorbent core is produced as part of a continuous web of absorbent cores, wherein the width of said continuous web is approximately equivalent to the width of a multiple number of cores, and wherein said absorbent material is deposited in a defined pattern.

18. The upper layer and the intermediate layer of absorbent material of claim 1 bonded together thermally, optionally with the use of steam.

19. The lower layer and the intermediate layer of absorbent material of claim 1 bonded together at discrete points, optionally using a thermally activated thermoplastic polymer or a pressure sensitive adhesive.

20. The thermoplastic polymer in claim 18 selected from the group polyolefins, polypropylene, polyethylene, and ethylene vinyl acetate.

21. The integrated absorbent core of claim 1 comprising more than one liquid permeable layer and more than one layer of absorbent material.

22. The upper layer of claim 1 comprising cellulose fibers with a basis weight in the range 20-1000 g/m², preferably in the range 20-500 g/m².

23. The material of the upper layer of claim 1 comprising 50-100 % cellulose.

24. The upper layer of claim 1 comprising at least 1% synthetic materials selected from the group polyolefins, polypropylene, polyethylene, polyamides, polyesters and polyetheresters.

25. The material of the lower layer of claim 1 selected from the group polyolefins, polypropylene, polyethylene, polyamides, polyesters and polyetheresters.

26. A final absorbent article comprising the absorbent core with integrated barrier of claim 1.

27. A final absorbent article comprising the absorbent core with integrated barrier of claim 16.

28. The final absorbent article of claim 1 comprising a backsheet or external covering with a minimum air permeability of 400 m/s at 196 Pa and a hydrohead less than about 60 cm.

29. The final absorbent article of claim 16 comprising a backsheet or external covering with a minimum air permeabil-

ity of 400 m/s at 196 Pa and a hydrohead less than about 60 cm.

30. The manufacture of the web of cores of claim 1 comprising a step wherein said web is slit longitudinally.

31. The manufacture of the web of cores of claim 1 comprising a step wherein said web is cut transversely.

32. The manufacture of the web of cores of claim 1 comprising a step wherein said web is trimmed.

33. The manufacture of the web of cores of claim 1 comprising a festooning step.

34. The converting of the web of cores of claim 1 into a final absorbent article comprising a festooning step.

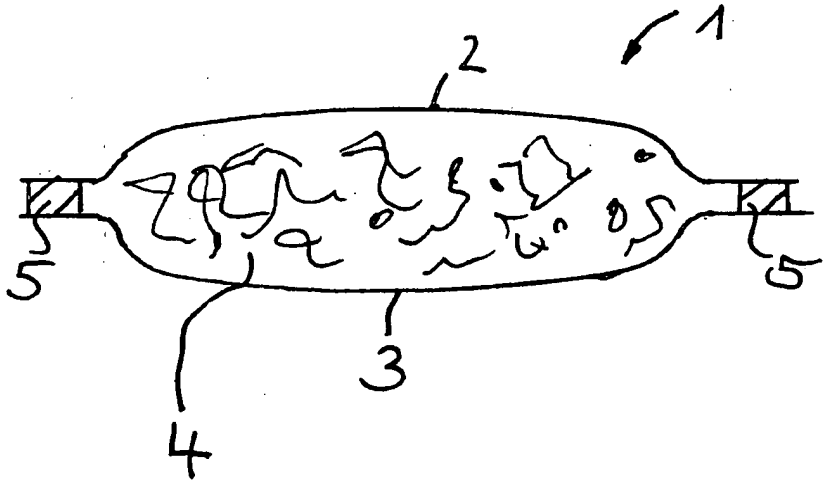
35. A process for the manufacture of intermediate absorbent products comprising the steps:
a) optionally preparing air laid paper or air laid composite material to be used as a web-like substrate,
b) depositing absorbent material, odor controlling material, and optionally thermoplastic binder, onto a web-like substrate,
c) bonding said absorbent material and odor controlling material to the substrate, preferably with the use of heat,
d) depositing adhesive material at least in longitudinal strips, preferably along the intended core perimeters, onto the substrate,

e) applying a further web-like sheet on top of the assembly prepared in steps (a) to (c),

f) optionally repeating one or more of the steps (a) to (e) at least once,

g) optionally longitudinally slitting the web-like composite so obtained,

h) and festooning the slit or un-slit webs.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INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/EP 99/09491

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B01J20/28 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B01J A61F B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
30 August 2000	06/09/2000

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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